Clark Lake Watershed, Door County Wisconsin
Sensitive Area Report
November 2006

Dates of Survey: April 2006 - August 2006

Site Evaluators: Darrin Hoverson, Water Resources Graduate Student – UWSP
Nancy Turyk, Water Quality Specialist – UWSP
Justin Barrick – Water Resources Student – UWSP
Kyle Homan – Water Resources Student – UWSP

Authors: Darrin Hoverson and Nancy Turyk

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Note:

A compact disc of available images and data not included in the report will be made available upon request.

List of Figures, Tables, and Appendices

Summary

Most of the riparian regions around Lost Lake and Logan Creek are intact and in good condition. The riparian vegetation is providing good habitat and is functioning to slow and filter runoff water draining to the water bodies. Efforts should be made to protect this healthy condition by utilizing a variety of tools including providing information to riparian landowners, strengthening and enforcing the shoreland zoning ordinances, providing incentives, obtaining conservancy easements, and/or purchasing land.

All of the areas around Clark Lake that are identified in this document play a role in supporting the lake's ecosystem. However, in addition to taking action to protect these areas efforts should be made to improve conditions in the riparian area of the lake. As a first step riparian land use around the lake should be consistent with the rules in the county zoning ordinance.

The Clark Lake watershed is truly a unique and beautiful region of Door County. Large tracts of intact white cedar swamp, undisturbed shorelines/shorelands, hardstem bulrush stands and other diverse plant communities, home to many species of fish, insects, reptiles, amphibians, birds, and other wildlife and all the while being a sought after destination by families, tourists, and others interested in what Clark Lake has to offer. Nineteen sensitive shorelines, three areas recommended for conservancy, Logan Creek, and twelve Lost Lake sensitive areas were identified in the watershed because they contribute to what is believed to be unique and critical habitat within the Clark Lake Watershed. Future knowledge of these areas, a plan to refine actions associated with the management/protection of these areas and education of the Clark Lake Watershed users will prove critical to protect and/or restore this valuable resource.

Introduction

Clark Lake is an 868 acre lake located in Door County in the Towns of Jacksonport and Sevastopol. It is a hardwater/drainage lake that receives water from direct precipitation, groundwater, and stream flow from Logan Creek that drains Lost Lake (Figure 1). Clark Lake drains to Lake Michigan after passing through a small dam. The south shore of Clark Lake includes Whitefish Dunes State Park, one of the most popular parks in Wisconsin. Clark Lake and the surrounding Door County is one of the prime tourist destinations in the Midwest. As a result, on some days Clark Lake is a heavily used body of water.

Clark Lake has a maximum depth of 25 feet, with a mean depth of 7 feet. There are approximately seven miles of shoreline. Two public boat ramps are present on the lake. Common fish species include northern pike, walleye, smallmouth bass, and panfish, with largemouth bass and trout also present. Land use in the Clark Lake watershed and the entire lake shore basin is dominated by agriculture, particularly the dairy industry; however, much of this area is currently being converted to residential developments, a trend which has been continuing over the past decade.

Lost Lake and Logan Creek lie in the 11,192 acre watershed of Clark Lake. Lost Lake is a 91 acre lake at the headwater of the Clark Lake watershed. It is drained by Logan Creek. Groundwater in the watershed feeds Lost Lake and Logan Creek throughout the year and these contributions can and do fluctuate with the changing levels of the water table. As the water table lowers, stretches of Logan Creek dry. Without additional recharge to groundwater these “losing” stretches migrate farther and farther up the watershed. These conditions have created unique vegetative and habitat characteristics to the region surrounding the Logan Creek and Lost Lake.

Much of the riparian areas around Lost Lake and Logan Creek are intact and in good condition. The riparian vegetation is providing good habitat and is functioning to help provide good quality water entering these waterbodies by surface runoff. Efforts should be made to protect this healthy condition by enforcing the existing shoreland zoning ordinances, obtaining conservancy easements, and/or purchasing land (when possible).

Much of the riparian and shallow regions of Clark Lake have not faired so well. Increased shoreland development that is inconsistent with shoreland zoning and lake use in the shallows has lead to a decrease in essential habitat, increased runoff, and increases in sediment and shoreline erosion and disturbance.

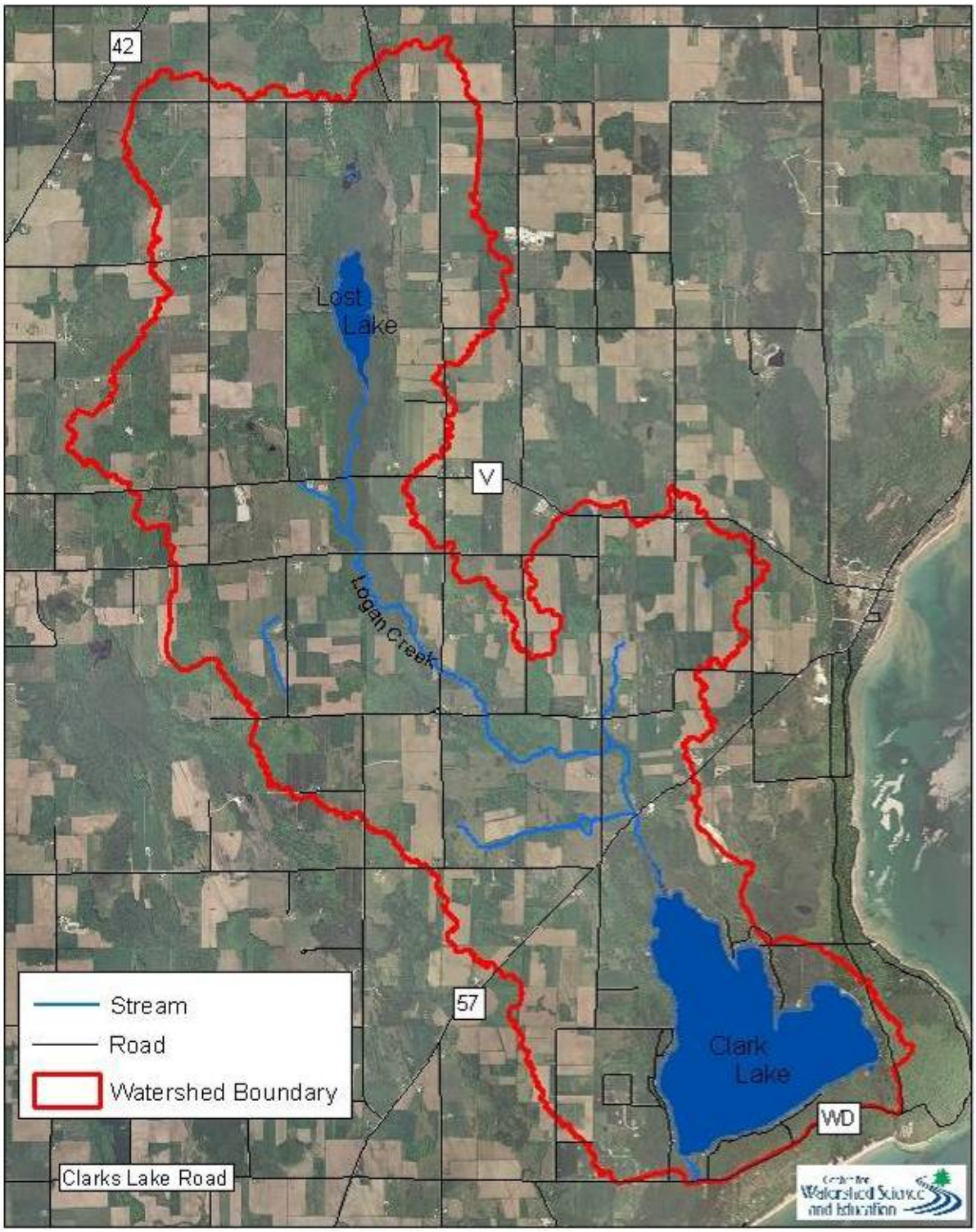

Figure 1. Clark Lake watershed boundary, hydrology, and land cover.

Clark Lake Sensitive Area Designations

A survey of sensitive areas adjacent to Clark Lake was conducted on August 20-24, 2006 by water resource staff and students from the University of Wisconsin – Stevens Point, Center for Watershed Science and Education. The purpose of the sensitive shoreline designation survey was to identify areas within and around the shoreline/shoreland of the lake that provides unique and/or critical ecological habitat.

Sensitive areas were areas that had native vegetation, minimal or no disturbance, offered critical and unique habitat for the fish and wildlife, and/or were important to the water quality/quantity of Clark Lake. These areas included abundant and diverse aquatic macrophyte beds, undisturbed shorelines with adjacent lowlands and uplands, areas of groundwater discharge, and those that contributed to the aesthetic value of Clark Lake.

Twenty-two sites on/around Clark Lake were designated as sensitive. These areas were grouped into three tiers based on the uniqueness, linkage of habitat to Clark Lake organisms, and/or benefits to water quality/quantity in Logan Creek or Clark Lake (Figure 2). Representative photos of each type of designation are included in this document. Photos of individual sites will be available on CD. Descriptions of individual sites can be found in the appendix of this document.

Historically, bulrush beds around Lost and Clark Lake were quite abundant but have been observed to be in decline in recent years. Bulrush beds provide critical habitat for spawning and young fish, produce food for waterfowl, reduce wave action and shoreland erosion, and stabilize bottom sediments. A map and discussion about the beds can be found in a sub-section of this report.

The information contained in this document can be used by citizens, conservation groups, municipalities, and agencies in a number of ways. Developing a plan with interested parties is an excellent way to identify specific goals for protection. Protection may be accomplished through education/information activities, obtaining conservancy easements, providing incentives, adhering to or strengthening and enforcing regulations, land purchase, and other creative means.

If some or all of these sites are to be officially designated as Wisconsin Critical Habitat, the WDNR will need to initiate this designation. This designation would provide protection for permit decisions regarding shoreline modifications and aquatic plant management. Comprehensive survey results can also be used to spur lake stewardship activities or to provide a wealth of educational information about a specific lake.

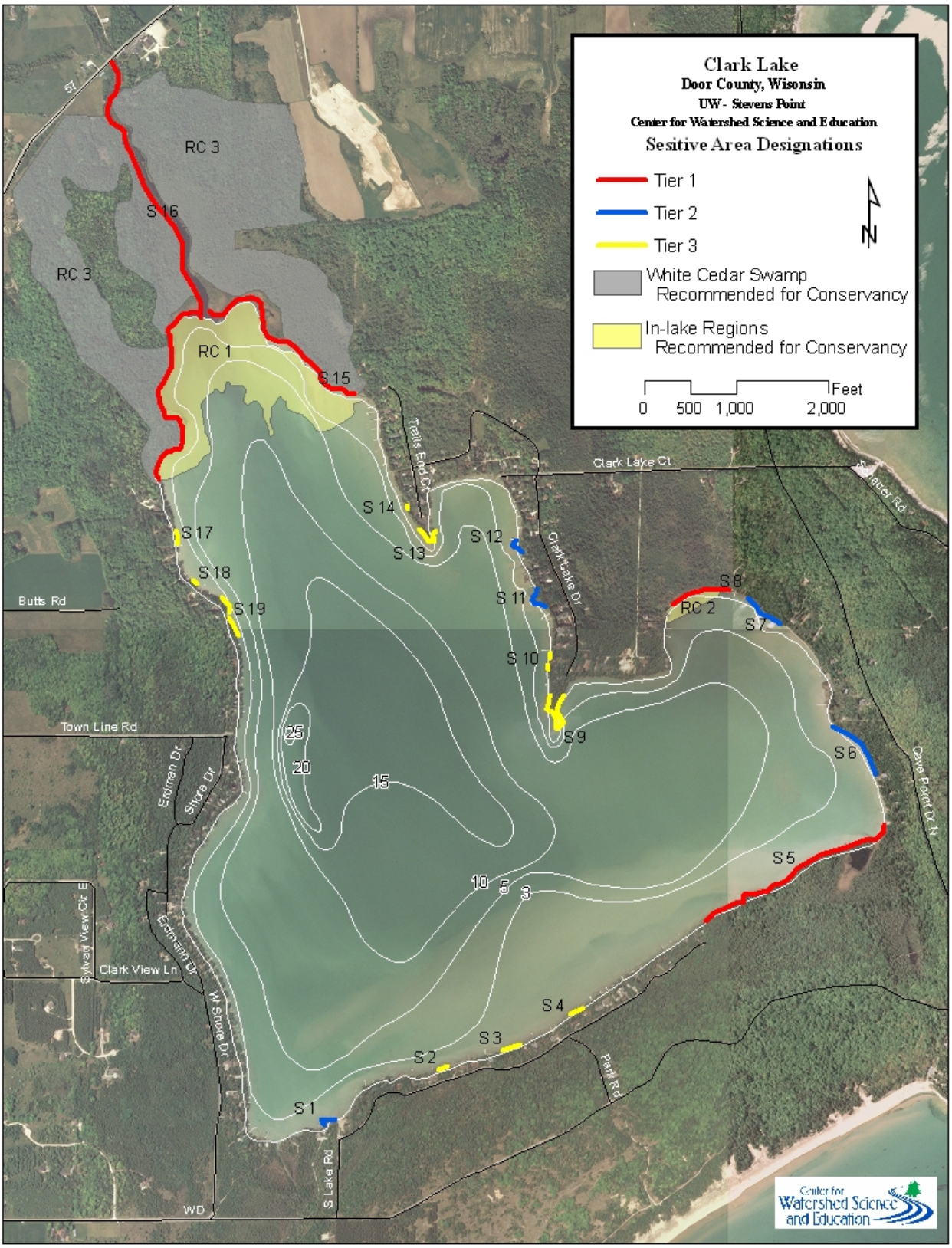

Figure 2. Sensitive areas in and adjacent to Clark Lake and Logan Creek.

CLARK LAKE - TIER 1 SITES

Sites in this designation include significant areas of aquatic vegetation and habitat that are unique and critical to Clark Lake, its biota, and water quality/quantity. Categories of these areas include:

- large tracts of White Cedar swamp,
- large areas of hardstem bulrush,
- large contiguous and diverse aquatic macrophytes beds
- endangered aquatic macrophyte
- groundwater seeps and springs

Tier 1 sensitive areas are considered the most important areas contributing to the present beneficial conditions to Clark Lake. These sites are large tracts of undeveloped shoreline which provide value to the fishery, wildlife, water quality, vegetation, and aesthetic beauty of Clark Lake. These areas include extensive diverse aquatic macrophyte beds with the greatest species richness, highest FQI, or the endangered species Spotted Pondweed (*Potamogetan pulcher)*, wild rice (*Zinzania palustris*), and large healthy beds of hardstem bulrush (*Scirpus acutus*) which are especially important to the fishery in pike, perch, and smallmouth reproduction as well as nursery and shelter areas for young of the year and prey species.

Riparian areas exhibit healthy conditions with low lying areas, woody debris, and diverse plant communities essential for reptile and amphibian species, insects, nesting birds and wildlife, and runoff buffering capabilities. These large intact shorelines and aquatic macrophyte beds aid in stabilizing shorelines and preventing wave erosion and resuspension of sediments.

Included in the Tier 1 category are four sensitive shorelines and three areas in and around Clark Lake that require special protection and are recommended for designation as conservancy.

Tier 1 Includes Sites: S5, S8, S15, S16, RC1, RC2, and RC3

Site **S5** is located on the south shore and is currently managed by the WIDNR as part of Whitefish Dunes State Park. S5 exhibited quality shoreline/shoreland habitat for wildlife with a mixture of wetland and upland plant species as well as fallen woody debris, lowland areas, and a strong hardstem bulrush community just off the shoreline. S5 is a large tract of shoreline in which many species of wildlife utilize for shelter, reproduction, and protection.

Site **S8** is located on northeast corner of the east bay of Clark Lake. This shoreline exhibited one of the densest and healthiest hardstem bulrush stands

just adjacent to the shoreline with a variety of other aquatic plant species present. The shoreline is a large section of undeveloped lowland cedar swamp with a lot of blow down, woody debris, and habitat for wildlife.

Site **S15** is the shoreline adjacent to RC1 in the north bay of Clark Lake. This shoreline was characterized by lowland and white cedar swamp with a diverse and abundant plant community. Very dense and healthy hardstem bulrush stands just adjacent to the shoreline are what we consider some of the highest quality stands in Clark Lake. This shoreline included many groundwater discharge areas from which the groundwater originated further up in the white cedar swamp of RC3. S15 along with S16 both exhibit quality habitat for wildlife and is likely the shoreline with the least disturbance in Clark Lake.

Site **S16** is the shoreline adjacent to Logan Creek and in the region of RC3. This region had numerous direct groundwater discharge springs which are critical to the water quality/quantity entering Clark Lake. A healthy and diverse plant community exists within this region in and along Logan Creek. Many of these plant species are found only within Logan Creek (Hoverson and Turyk, 2006). S16 exhibits quality wildlife and fish habitat with ample lowland, vegetation, and fallen woody debris along the creek edge. As stated previously S16 along with S15 is likely the least disturbed shoreline in Clark Lake.

Sites RC1, RC2 and RC3 are the primary areas around Clark Lake that are essential for the health of the Clark Lake aquatic ecosystem. We recommend them for conservancy designation.

RC1 is an in-lake location which is located at the mouth of Logan Creek and extends out into the north end of Clark Lake. This region is especially important to Clark Lake because it includes the most diverse and abundant plant community of the lake and the primary fishery/in-lake habitat (Aquatic Plant Survey, Hoverson and Turyk, 2006). Nineteen different plant species, many with high coefficients of conservancy or high in abundance colonize this area that is unlike any other location in the lake. Sensitive plants like wild rice (*Zinzania palustris*) inhabit this area. Fish, insects, reptiles, amphibians, and many other wildlife species thrive in this region of the lake.

RC2 is also a location of relatively high diversity and abundance in comparison to the rest of the lake. It is located in the north-east corner of the south-east bay. It includes a healthy hardstem bulrush community, little shoreline disturbance, and excellent habitat make it a candidate location to be recommended for conservancy.

RC3 is the region surrounding Logan Creek including its healthy aquatic plant community and numerous groundwater springs within the region is also being recommended for conservancy. White Cedar (*Thuja occidentalis*) dominates

the vegetation adjacent to Logan Creek and Clark Lake, acting as shoreland buffer. Numerous fish species utilize the open creek area for reproduction and shelter, countless insects live amongst the fallen debris and riffles, as well as many other birds and wildlife use the area for nesting, feeding, and shelter. Areas of groundwater inflow are desirable locations for many species of fish spawning reds.

Examples of Tier 1 sensitive areas:

Figure 3. View of S5

Figure 4. View of S8

Figure 5. View of S15

Figure 6. View of S16

Figure 7. View of RC1

Figure 8. View of RC2

Figure 9. View of RC 3

CLARK LAKE - TIER 2 SITES

Included areas exhibited quality aquatic vegetation with habitat for insects, fish, birds, amphibians, and reptiles. These are areas with intact lowland shorelines that are adjacent to urbanized/developed shoreland. Tier 2 sensitive areas are considered important areas contributing to the present beneficial conditions to Clark Lake but due to size and proximity to residential/disturbed areas were not considered Tier 1 sensitive areas.

Tier 2 Includes Sites: S1, S6, S7, S11, S12, and
All Hardstem Bulrush sites designated in Figures 12, 13, and 14.

These sites were designated because of their mid-sized, lowland tracts of undeveloped shoreline which enabled them to provide values to the fishery, wildlife, water quality, vegetation, and aesthetic beauty of Clark Lake. The riparian areas exhibited healthy conditions with low lying areas adjacent to upland areas essential to nesting birds, reptiles, amphibians, insects, other wildlife, and its buffering capabilities. All hardstem bulrush beds designated as sensitive sites that were not included in Tier 1 are included in Tier 2.

Hardstem bulrush *(Scirpus acutus*) is becoming less common in areas where the vegetation once dominated. These beds of vegetation stabilize shorelines, prevent wave erosion and mixing of substrates, and are important food and habitat for fish, birds, insects, and other Clark Lake wildlife. Stands of hardstem bulrush were mapped in summer 2006 by J. Barrick and R. Crunkilton (Figures 12, 13, 14).

Examples of Tier 2 sensitive areas:

Figure 10. View of S6

Figure 11. View of S11

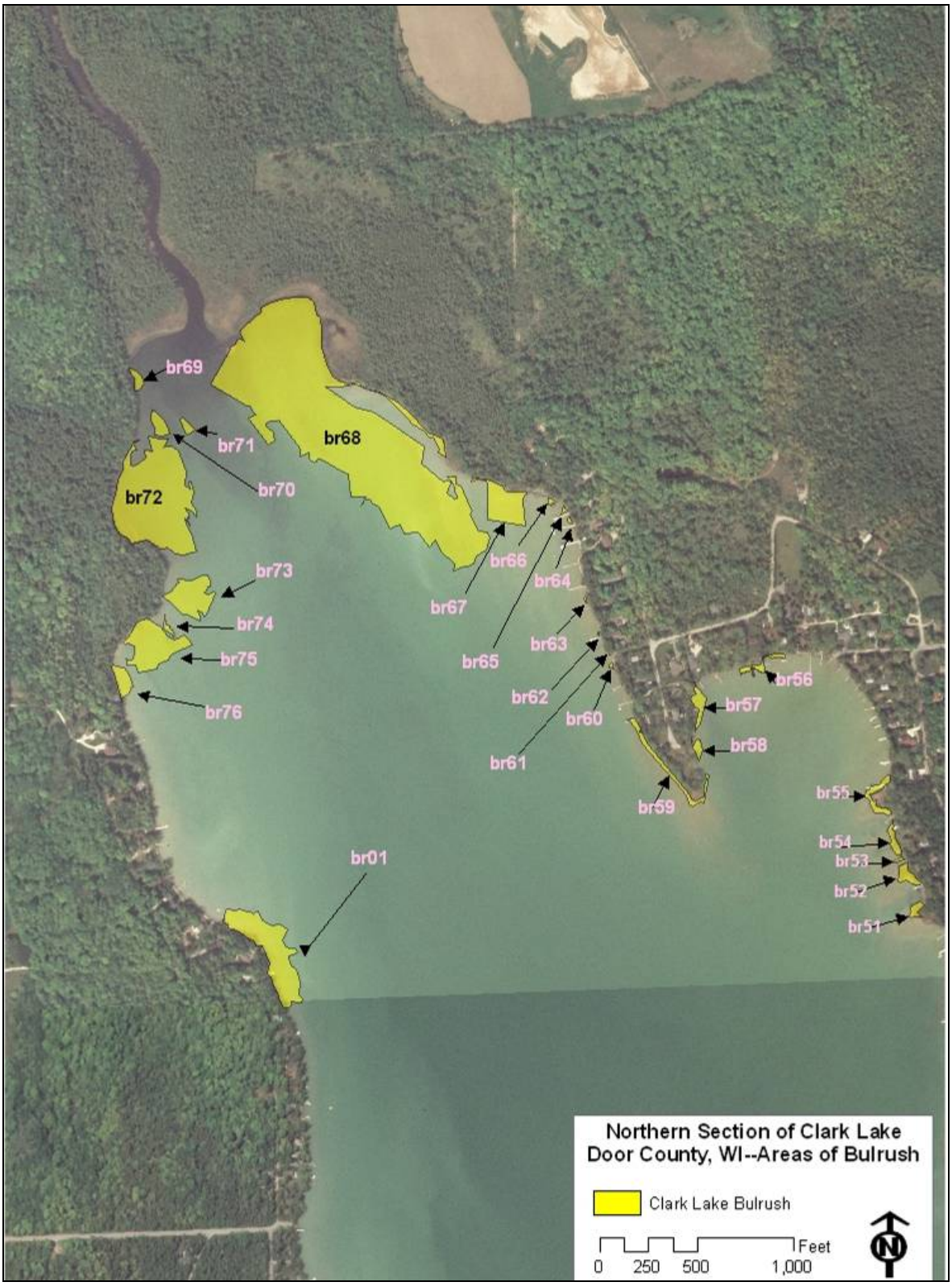

Figure 12. Location of hardstem bulrush beds in the north section of Clark Lake.

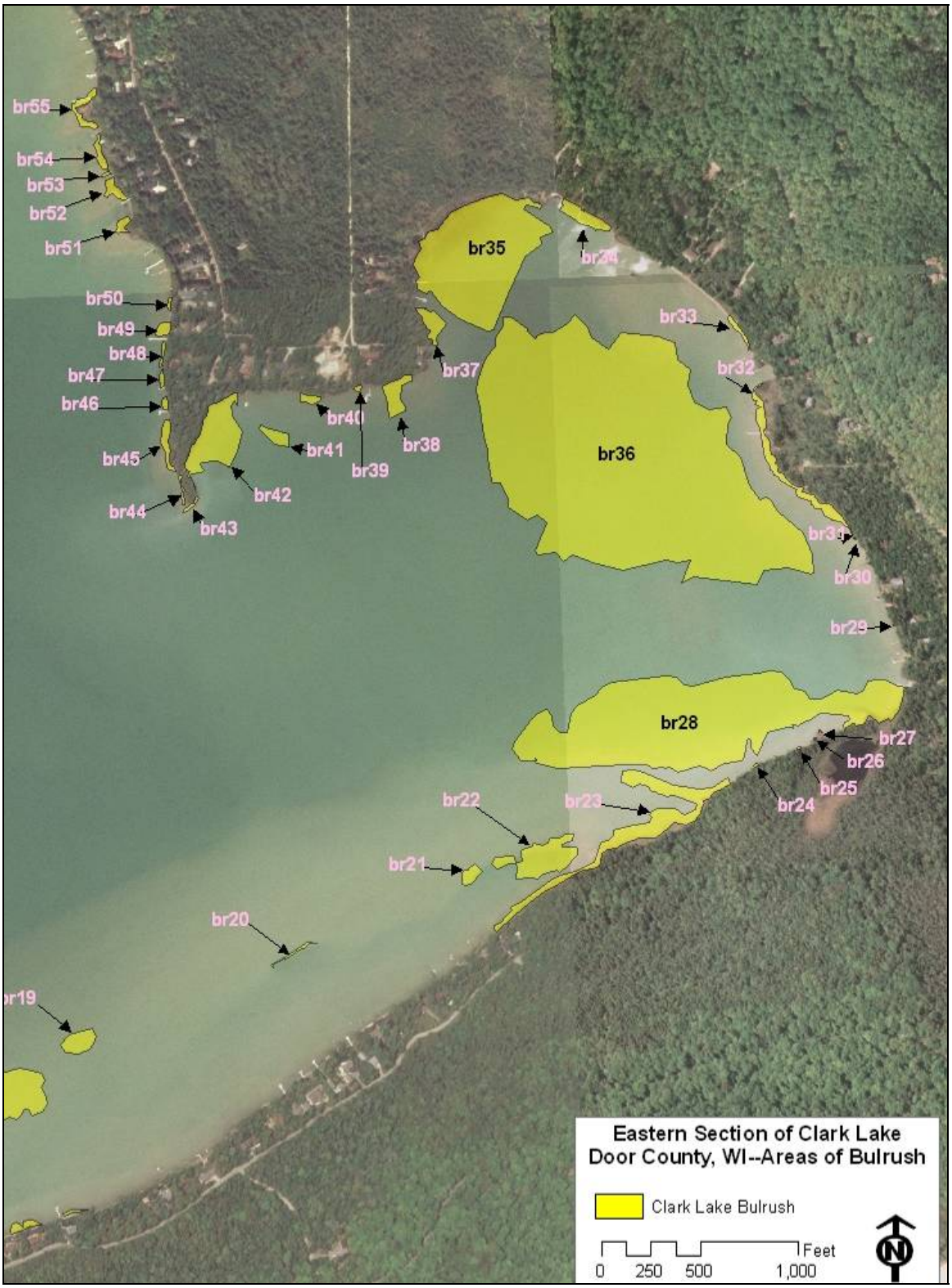

Figure 13. Location of hardstem bulrush beds in the east section of Clark Lake.

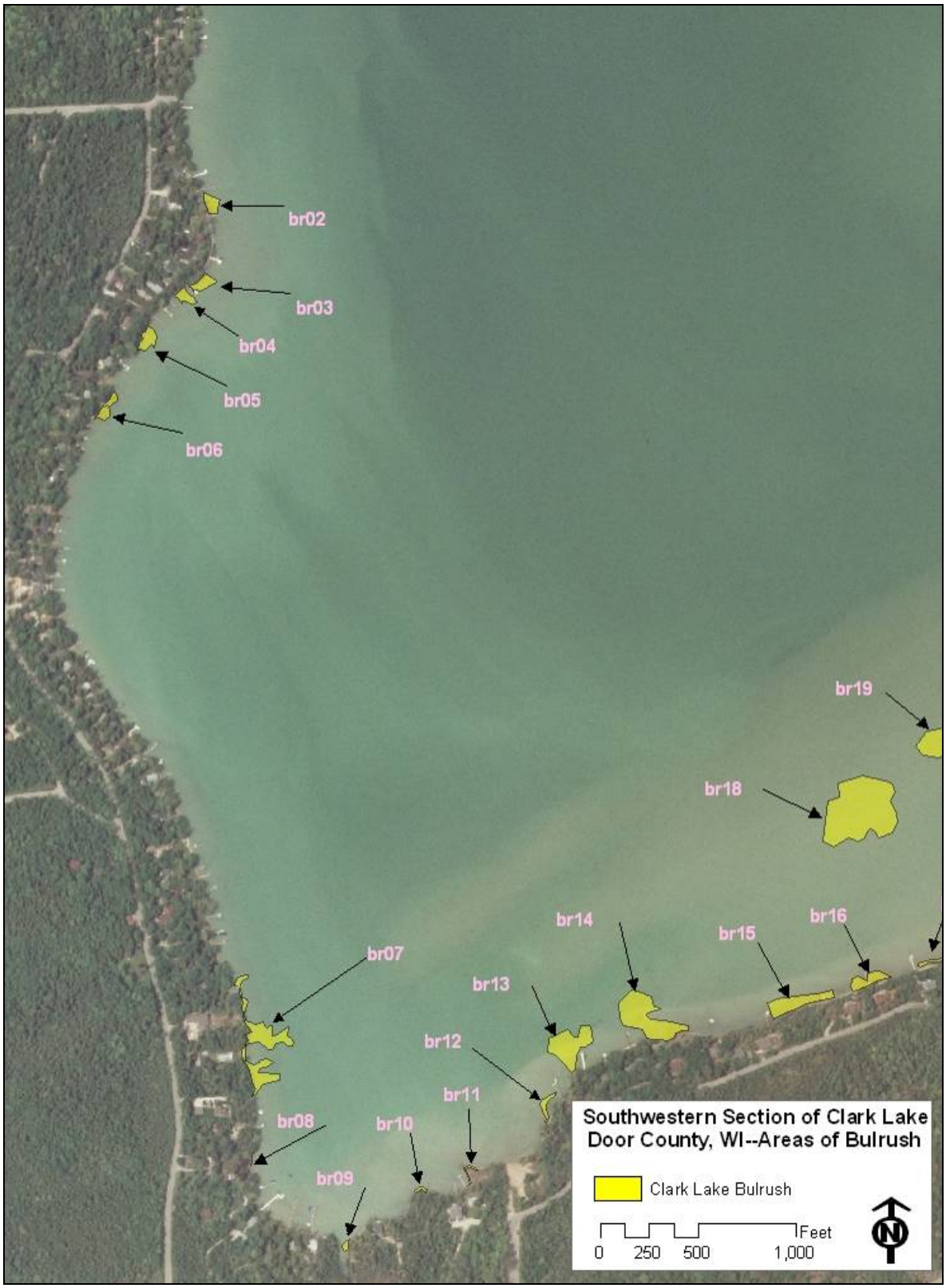

Figure 14. Location of hardstem bulrush in the southwest section of Clark Lake.

CLARK LAKE - TIER 3 SITES

These areas are small parcel-sized tracts of shoreline adjacent to or surrounded by developed shoreland and upland and represented the only good habitat in these regions of the lake. They provide important aquatic vegetation and habitat adjacent to urbanized/developed shorelines and habitat for insects, fish, birds, amphibians, and reptiles, and other wildlife

Tier 3 Includes Sites: S2, S3, S4, S9, S10, S13, S14, S17, S18, and S19

These sites were parcel-sized tracts of undeveloped shoreline which provide values to the fishery, wildlife, water quality, vegetation, and aesthetic beauty of Clark Lake. Riparian zones were in good condition and were adjacent to upland areas with woody debris, and shoreline vegetation that are essential to nesting birds, insects, and other wildlife, as well as important for their shoreland buffering capabilities. These areas "were islands of habitat" amongst shorelines dominated by development. Tier 3 sensitive areas are considered important areas contributing to the present beneficial conditions to Clark Lake but due to their small size and proximity to upland, residential and developed shorelines were not included as Tier 1 or 2 sensitive areas.

Examples of Tier 3 Sensitive Areas:

Figure 15. View of S9

Figure 16. View of S19

Logan Creek Sensitive Area Survey

Logan Creek was surveyed on foot and by boat between April and August 2006. The riparian corridor up to 20 ft from the stream edge was healthy and intact for almost the entire length providing abundant habitat and buffering capability. There was no significant erosion and little evidence of domestic animal use. Only a few small sections of pasture were observed along the stream's edge and these all included at least a small buffered region and little direct contact with the stream's edge.

Logan Creek receives its water from upstream Lost Lake, groundwater, runoff, and direct precipitation. Groundwater plays an important role in Logan Creek and is critical to sustaining life within the creek. Therefore, we have identified areas of groundwater inflow as sensitive regions within the creek. Throughout the year the amount of groundwater entering the stream fluctuates with changes in the water table level. As the water table lowers, stretches of Logan Creek become dry as the amount of groundwater entering is less than the amount of water leaving the stream. With a lack of precipitation and groundwater recharge these stretches migrate farther upstream. These conditions can be detrimental to the biota in Logan Creek and should be considered fragile and susceptible to impairment. Landuse changes that may increase the amount of water removed from the ground, increase the runoff to Lost Lake and Logan Creek from increased impervious surface/development and usage may affect the biotic community (aquatic invertebrates, fish, and other wildlife) and water quality/quantity of Logan Creek and downstream Clark Lake (Szcztyko and Dimick, 2005).

Fish habitat in Logan Creek is vitally important to sustaining a healthy fish community in Clark Lake. Multiple fish species use Logan Creek for protection, reproduction, and feeding. The lower section of Logan Creek is more readily usable by many of the fish species in Clark Lake throughout the year, but some of the reaches above State Highway 57 cease to flow during times of low groundwater recharge. (McGinley and Hoverson, 2006). Iowa Darters (*Etheostoma exile*) (Szcztyko and Dimick, 2005), Northern Pike (*Esox lucius*), and White Suckers (*Catostomus commersoni)* (personal communications with Paul Schumacher) have been known to spawn further upstream of State Highway 57. Yellow Perch (*Perca flavescens*) and Common Shiners (*Luxilus cornutus*) are very common in the lower reach during the spring spawning season and are likely to also be spawning in Logan Creek.

Logan Creek was also found to have a healthy aquatic macrophyte community and appears to be free of non-native species. In August 2006 we conducted a qualitative survey of aquatic macrophytes in Logan Creek between State Highway 57 and Clark Lake. We identified three species that did not occur in

the Clark Lake; *Potamogeton filimormis, Ranunculus flabellaris*, and *Callitriche palustris*. These species were found in varying growth of very dense and frequent to less frequent and single plant specimens. *Callitriche palustris* in particular was found around and indicated groundwater upwelling (Hoverson and Turyk, 2006). There was evidence of scouring of the creekbed and removal of aquatic macrophytes from boating activity in Logan Creek (Figure 17). Continued and repeated activity with boats or propellers that ride too low in the creek may adversely impact the aquatic macrophytes community in Logan Creek.

Overall, the aquatic macrophyte community appears healthy in the current conditions in Logan Creek; however, any substantial changes to the creek, its shorelines and/or water quality/quantity may promote changes to this community. These changes could alter conditions in Clark Lake and is again why Logan Creek is considered sensitive for the health of the creek itself and the lake.

LOGAN CREEK – SENSITIVE AREAS

Logan Creek in its entirety is considered a sensitive area. The attributes that we used in this designation included groundwater discharge, significant habitat for insects, fish, and other wildlife, important native vegetation, and those contributing to the aesthetic beauty of Logan Creek. These areas are considered sensitive because of potential changes to these sensitive areas will affect Clark Lake water quality and/or quantity. Since most of Logan Creek and its riparian corridor are in good condition we did not tier the sites.

Groundwater provides a significant part of the water and temperature budgets for Logan Creek and is critical to sustaining life in the creek. Therefore, we have designated the major areas of groundwater inflow to the creek as sensitive. These regions are shown in red in Figure 18.

White Cedar wetlands are adjacent to large stretches of Logan Creek (Figure 18). These wetlands are hydraulogically and biologically connected to Logan Creek and provide habitat for amphibians, reptiles, birds, and aquatic and terrestrial insects. In addition they provide a winter shelter for many creatures such as white-tailed deer, turkey, grouse, and fox as well as wintering grounds for many insects. Water temperature and quantity, habitat structure, food availability, sediments and nutrients are controlled by the surrounding wetland and upland adjacent to Logan Creek.

The wetlands store water and slowly release it to Logan Creek providing water to the creek even during periods of low or no precipitation. This storage and slow release help to filter sediments and nutrients that are moving toward

Logan Creek in runoff water and stabilizes the stream bank and upland from eroding away into the creek and out to Clark Lake. The riparian tree canopy reduces direct sunlight and fast changes in air temperature that can adversely modify the water temperature while providing a food source to some of the primary feeders in the stream's food web.

Figure 17. Evidence of scouring of the Logan Creek creekbed.

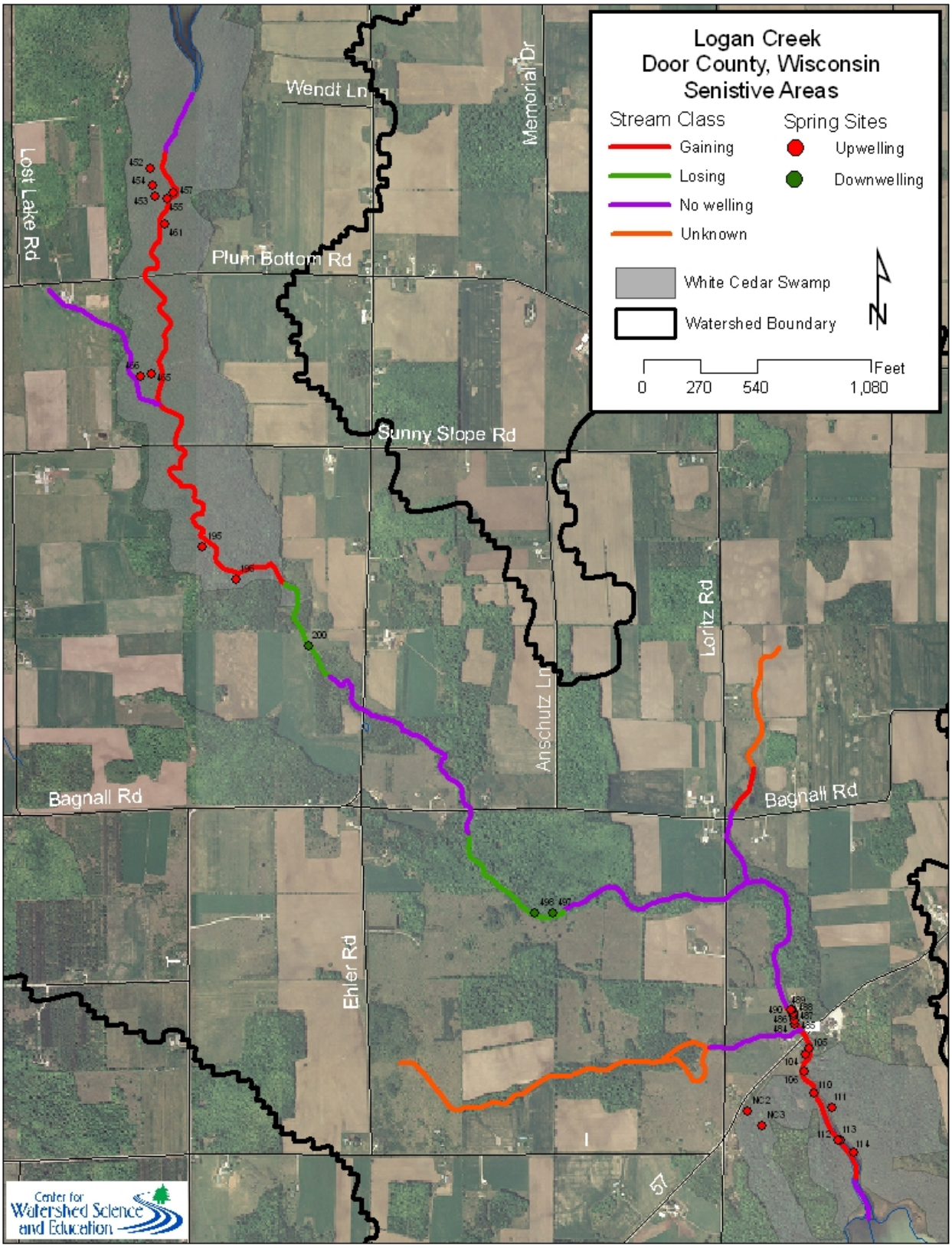

Figure 18. Map of Logan Creek showing springs and regions of groundwater inflow and outflow and adjacent cedar swamp complexes.

Examples of Logan Creek sensitive areas:

Figure 19. White Cedar wetland surrounding much of Logan Creek

Figure 20. Groundwater springs and water cress beds just north of Hwy 57

Lost Lake Sensitive Area Survey

Lost Lake is the headwaters to Clark Lake and because of this the condition of Lost Lake can and does affect downstream Logan Creek and Clark Lake. Lost Lake is 91 acres with the mean depth around 2 feet. Bottom sediment can be easily disturbed with boats due to the shallow depth, however little boating activity occurs on Lost Lake and currently most of the shoreline is undeveloped and has minimal areas with human influence.

LOST LAKE SENSITIVE AREAS

A low lying white cedar wetland surrounds Lost Lake as well as dense beds of healthy hardstem bulrush (Figure 21). These areas are considered important to the fishery, wildlife, water quality, aquatic and riparian vegetation, and aesthetic beauty of Lost Lake. Riparian areas exhibit good conditions with low lying areas essential to nesting birds, insects, and other wildlife while exhibiting buffering capabilities. Intact shorelines and aquatic vegetation beds aid in stabilizing shorelines and preventing wave erosion and substrate mixing. Therefore these stands of hardstem bulrush and white cedar swamp should be considered for conservancy or other forms of protection.

Current hardstem bulrush conditions on the lake reveal a healthy population, but due to its relationship with Clark Lake, hardstem bulrush should be monitored for changes exhibited on Clark Lake. Major hardstem bulrush stands around the lake are described as Sites LLSS 1 – LLSS 12 in Figure 21.

Monoculture stands of broad leaved cattail (*Typha lattiflora*) and common reed (*Phragmites australius)* exist on the north and northwest sides of the lake and it appears to be encroaching on the adjacent bulrush beds. We have defined these areas as management areas due to the aggressive nature of these species in which continued monitoring should be done to examine changes that may be detrimental to the Lost Lake macrophyte community.

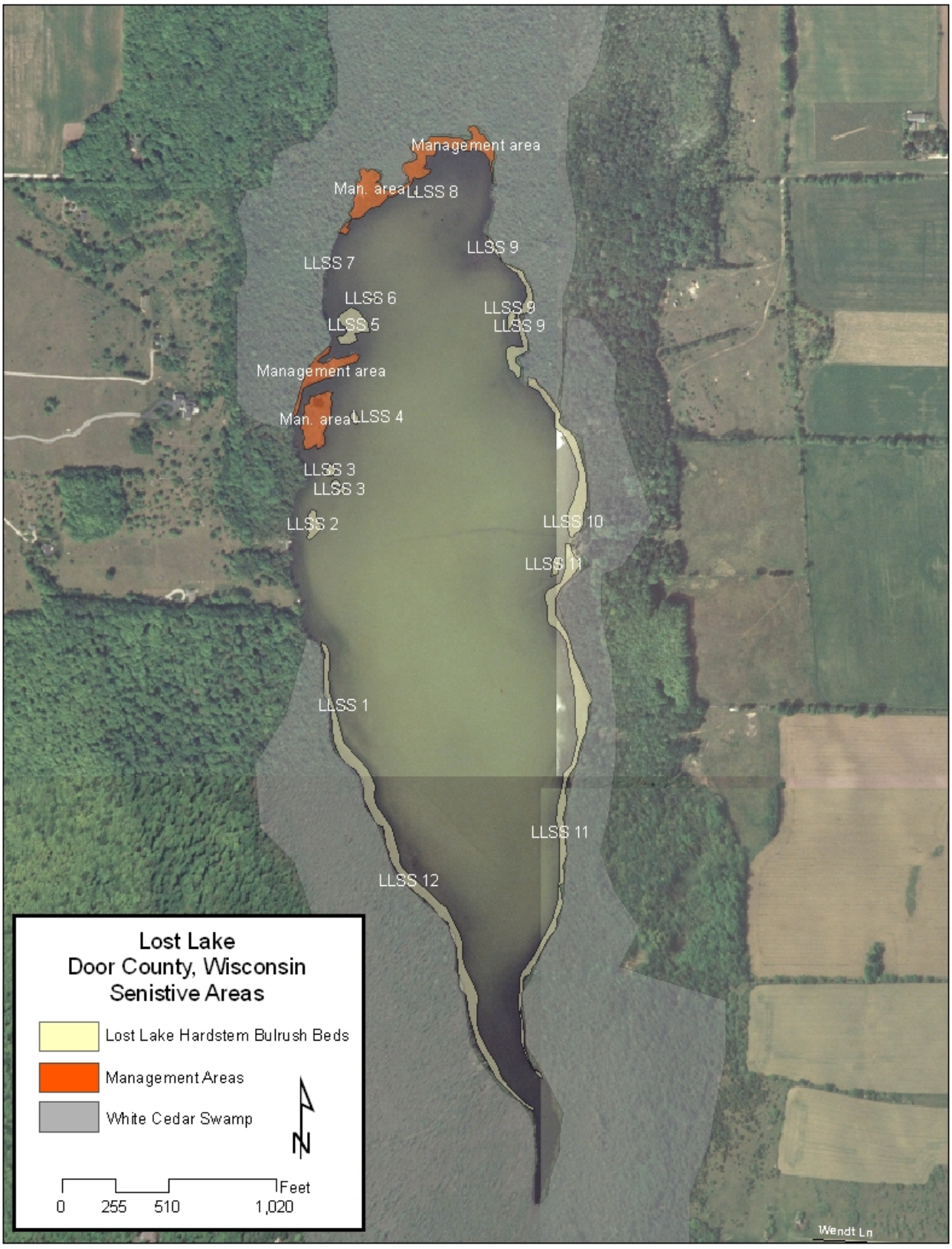

Figure 21. Map of Lost Lake showing hardstem bulrush beds, white cedar swamps, and management areas.

Examples of Lost Lake Sensitive Areas:

Figure 22. Lost Lake Sensitive Site 3

Figure 23. Lost Lake Sensitive Site 12

Appendix 1	Clark Lake, Door County Wisconsin	Sensitive Area Designation	
	Site ID	**Location***	**Observations**
Tier 1	S 5	Whitefish Dunes Park, southeast shoreline	Hardstem Bulrush, white cedar shoreline, no disturbance
	S 8	Northeast corner of east bay	Very thick and healthy hard stem bulrush, minimal disturbance
	S 15	North shoreline in north bay running from last house on west shore to first house on east shore	Most diverse and abundant in plant growth in lake, organic substrate, white cedar shoreline without disturbance
	S 16	Logan creek from Hwy 57 to Clark Lake	Diverse plant community (some not found in lake), many groundwater springs, lots of wildlife habitat
	RC 1	Region outside of mouth of Logan Creek out to the vegetation edge in deeper water	Most diverse and abundant in plant growth in lake, organic substrate, lots of habitat and most important region for fish
	RC 2	Region outside of SS 8 out the the edge of the hardstem bulrush	Very thick and healthy hardstem bulrush, minimal disturbance
	RC 3	Low-lying wetland region surrounding Logan Creek and RC1	White cedar wetland with many upwelling springs, diverse and abundant plant growth, and critical shoreland habitat
Tier 2	S 1	Vegetated sand point to the west of the public swimming beach	Low-lying vegetated shoreline with lots wildlife habitat
	S 6	East shore of East bay	Low-lying vegetated shoreline next to upland with lots of wildlife habitat
	S 7	East shore of East bay	Low-lying vegetated shoreline next to upland with lots of wildlife habitat and healthy hardstem bulrush population
	S 11	Rock and sand point on east shore of Miller Bay	Low-lying vegetated shoreline next to upland with lots of wildlife habitat and healthy macrophyte community
	S 12	Rock and sand point on east shore of Miller Bay	Low-lying vegetated shoreline next to upland with lots of wildlife habitat and healthy macrophyte community
Tier 3	S 2	South shore of south bay	Small tract of intact shoreline with healthy bulrush population and upland shoreland habitat for wildlife
	S 3	South shore of south bay	Small tract of intact shoreline with healthy bulrush population and upland shoreland habitat for wildlife
	S 4	South shore of south bay	Small tract of intact shoreline with healthy bulrush population and upland shoreland habitat for wildlife
	S 9	Point on the north shore of the east bay	Intact shoreline and upland shoreland habitat for wildlife
	S 10	Two small bulrush beds on the east shore of Miller Bay south of SS 11	Small tract of intact shoreline with healthy bulrush population and upland shoreland habitat for wildlife
	S 13	Miller Point	Small tract of intact shoreline and upland shoreland habitat for wildlife
	S 14	Just north of Miller Point	Small tract of intact shoreline, upland shoreland habitat for wildlife and small hardtem bulrush population close to shore
	S 17	Northwest shoreline just south of RC1	White cedar upland with little shoreland disturbance and small hardstem bulrush population
	S 18	Northwest shoreline	White cedar upland with little shoreland disturbance and small hardstem bulrush population
	S 19	Northwest shoreline	White cedar upland with minimal shoreland disturbance and healthy hardstem bulrush population

* All location should be referenced to map for more location information

Appendix 2 Logan Creek Groundwater Upwelling and Downwelling
Coordinate System : NAD 83 HARN Wisconsin Transverse Mercator

ID	Groundwater (Up/Down)	Description	Easting	Northing
200	Downwelling	Stream bottom losing all water, downwelling region	737047	503729
497	Downwelling	Downwelling section of LC rock cobble sand streambed	738243	502518
498	Downwelling	Just upstream of downwelling good flow	738159	502517
104	Upwelling	Groundwater upwelling area numerous west side	739452	501899
105	Upwelling	Groundwater upwelling area numerous west side	739470	501925
106	Upwelling	Groundwater upwelling area numerous west side	739450	501816
110	Upwelling	Groundwater upwelling area	739500	501716
111	Upwelling	Groundwater upwelling area east side	739586	501655
112	Upwelling	Groundwater upwelling area both sides	739634	501503
113	Upwelling	Groundwater upwelling area both sides	739620	501503
114	Upwelling	Groundwater upwelling area East side of Logan Creek	739696	501444
195	Upwelling	Large upwelling area, bedrock at surface, gravel	736534	504180
196	Upwelling	Bedrock and cobble in streambed	736695	504030
452	Upwelling	Large upwelling area	736222	505949
453	Upwelling	Large upwelling area	736234	505867
454	Upwelling	Increased flow from stream head of Lost Lake	736248	505818
455	Upwelling	LC upwellling from the East	736304	505807
457	Upwelling	Farther east of easterly contribution area	736335	505836
461	Upwelling	Further yet up easterly contribution area	736301	505686
465	Upwelling	Upwelling from west	736264	504983
466	Upwelling	Upwelling from west	736213	504969
484	Upwelling	Large upwelling region, multiple springs	739398	502039
485	Upwelling	Large upwelling region, multiple springs	739398	502053
486	Upwelling	Large upwelling region, multiple springs	739391	502076
487	Upwelling	Spring seemed to have been higher than at this time	739388	502093
488	Upwelling	Large upwelling region, multiple springs	739391	502090
489	Upwelling	East edge of Logan Creek upwelling	739385	502106
490	Upwelling	First upwelling springs observed prior to flow, no flow	739376	502103
NC2	Upwelling	East pond upwelling region south of Hwy 57	739191	501618
NC3	Upwelling	West upwelling area south of Hwy 57, large contribution	739261	501553

Appendix 3	Lost Lake, Door County Wisconsin	Sensitive Area Designation
Site ID	**Location***	**Observations**
LLSS 1	Small island of bulrush off of east shore	Small island of bulrush, wildlife habitat
LLSS 2	Large bed of island bulrush off of west shore	Island of bulrush, wildlife habitat
LLSS 3	Group of 3 islands off of west shore	Small islands of bulrush, wildlife habitat
LLSS 4	Island off of west shore management area	Island of bulrush, wildlife habitat
LLSS 5	Large bed of bulrush off of shore along east-northeast shore	Large healthy bulrush bed
LLSS 6	Island in northwest bay	Small island of bulrush surrounded by cattail
LLSS 7	Along northwest shore, small section	Shoreline bulrush bed
LLSS 8	Bulrush island out in front of north shore management area	Shoreline bulrush bed
LLSS 9	Northeast shoreline and adjacent bulrush islands	Shoreline bulrush bed
LLSS 10	East shoreline	Shoreline bulrush bed
LLSS 11	Southeast shoreline	Shoreline bulrush bed
LLSS 12	Southwest shoreline	Shoreline bulrush bed
Management areas: Four management areas along the Northeast and East shores have been identified as large stands of cattail and common reed which are both highly aggressive plants that have been known to overtake a plant community.		

* All location should be referenced to map for more location information

Appendix 4 - Sensitive Area Coordinates for Clark Lake and Lost Lake
Coordinate System: NAD 83 HARN Wisconsin Transverse Mercator

SAD ID	Easting	Northing	SAD ID	Easting	Northing
S 9	740965.1	499910.9	S 15 / RC 1	739699.1	500597.9
S 9	741053.4	499906.8	S 15	740264.2	500871.0
S 8 / RC 2	741396.5	500209.8	S 14	740463.9	500530.0
S 8 / RC 2	741572.8	500228.7	S 13	740512.6	500447.1
S 7	741616.8	500236.5	S 13	740586.8	500457.8
S 7	741678.7	500131.6	S 12	740827.9	500429.7
S 6	742055.3	499684.7	S 12	740810.7	500396.1
S 6	741915.5	499833.7	S 11	740856.6	500224.2
S 5	741515.6	499209.6	S 10	740956.2	500059.3
S 5	742094.7	499529.6	S 10	740957.4	500059.1
S 4	741087.9	498880.7	S 10	740959.5	500008.7
S 3	740913.2	498766.3	S 10	740959.7	500008.4
S 2	740660.5	498699.5	S 1	740271.6	498501.5
S 19	739883.8	500164.2	RC 3	739191.5	501618.3
S 19	739929.2	500152.9	RC 3	739261.0	501552.7
S 19	739954.8	500104.4	RC 2	741487.4	500088.5
S 18	739806.8	500268.2	RC 1	739818.7	500685.7
S 17	739755.5	500402.0	RC 1	740196.2	500768.1
S 16 / RC 3	739719.6	501327.6	LLSS 9	736284.8	507719.5
S 16 / RC 3	739729.0	501383.7	LLSS 9	736306.4	507661.5
S 16 / RC 3	739702.9	501440.7	LLSS 9	736327.5	507586.6
S 16 / RC 3	739639.6	501509.7	LLSS 9	736330.8	507544.2
S 16 / RC 3	739525.9	501754.4	LLSS 9	736342.6	507525.9
S 16 / RC 3	739501.4	501765.7	LLSS 8	736188.1	507777.5
S 16 / RC 3	739479.1	501939.4	LLSS 7	736095.2	507674.2
S 16 / RC 3	739458.9	501995.7	LLSS 5 / LLSS 6	736110.5	507611.0
S 16 / RC 3	739451.5	501898.8	LLSS 4	736068.1	507406.3
S 16 / RC 3	739469.6	501924.6	LLSS 3	736060.5	507360.2
S 16 / RC 3	739449.7	501815.6	LLSS 2	736040.3	507278.7
S 16 / RC 3	739450.5	501815.4	LLSS 12	736092.9	507120.4
S 16 / RC 3	739450.3	501820.1	LLSS 12	736429.1	506407.4
S 16 / RC 3	739508.8	501726.5	LLSS 11	736423.8	507275.9
S 16 / RC 3	739500.1	501715.5	LLSS 11	736406.6	507162.0
S 16 / RC 3	739586.1	501655.3	LLSS 11	736437.2	507010.6
S 16 / RC 3	739633.6	501503.4	LLSS 11	736431.5	506928.8
S 16 / RC 3	739619.8	501502.9	LLSS 11	736369.4	506650.7
S 16 / RC 3	739695.7	501443.9	LLSS 11	736408.2	506501.9
S 16 / RC 3	739697.1	501434.0	LLSS 10	736386.0	507457.3
S 16 / RC 3	739762.8	501251.5	LLSS 10	736415.0	507306.9
S 15 / RC 3	739738.5	501023.4	LLSS 1	736127.4	507033.5

Coordinates of locations are reference points within the sensitive sites and should be used with location map to determine extent of length and area for each site.

Appendix 5	Clark Lake Hardstem Bulrush Mapping	
Site ID	**Location**	**Description**
br01	First bed north of west shore boat landing.	--Some dense inner bulrush with mainly sparser outside areas --About 120' max. perpendicular distance from shore.
br02	First bed south of west shore boat landing.	--About 75' of the shoreline, extending max. distance of 40' out and is dense for the first 10', then sparse. --Max. bulrush depth of about 1.5' with no stems broken.
br03	Just as the Point south of boat landing starts wrapping west on the south side.	--About 60' long and 40' out --Some dense bulrush in the first 5' from shore, rest is rather sparse. --Max. depth of about 2' with no stems broken.
br04	About 50' south of "br03" separated by a pier	--About 20' long and 60' out --Medium to sparse density throughout --Max. depth of about 2'. *Southern 10' appears to have been cut by the landowner this past year.
br05	About 200' south of "br04"	--About 125' long and 50' out --Dense near shore and sparse on outer 25-30' --Inclusive of a pier --Max. depth of about 2' with no stems broken.
br06	About 250' South of "br05" with a 1' diameter White Birch tree on the north side of the pier.	--Shaped like an hour glass with a pier in the middle absent of bulrush. --Basically 2 smaller patches separated by the pier, but are very similar. --Extremely dense. Very, very thick. --Combined 120' long and 40' out. --Max. depth of 2.5' with a few stems (about 20) broken on the outer 1' perimeter.
br07	In very SW corner of the lake near outlet of lake	--About 600' long and up to 100' out: very sparse—hardly any seeds, looks to have been grazed upon. --Max. depth of about 3' with significant stems broken.
br08	About 200' south of "br07"	--About 40' long and 2-5' out. --Present onshore and extend out to 1' depth of water. --Not a very big patch. --Mainly three square sedge.
br09	In the outlet canal of the lake on the east side.	--Very dense pockets of it, but overall a small patch. --Three square sedges on inside of the bulrush (East—near steel bank). --Max. depth of about 1.5' with a few broken stems on the outer 6" perimeter.
br10	On little sand point just east of the first pier east of Outlet canal and next point west of "br11".	--40' long and 1-5' out...very small. --Sparse, including three square sedge. --Max. depth of about 1' with no broken stems.
br11	On first point west of public beach.	--About 70' of contour, max of 5' out --Appears to be younger, newer growth on the shore in dampened shoreline areas. --Very dense on shore and into the little cattail marsh. --Mainly sedges on the inner part of west side with only
br12	First patch east of the Public Beach.	--About a 40' little finger, fairly dense, but very small. --Max. depth of about 2' with noticeable broken stems on outer 1' perimeter.
br13	About 100' east of "br12" on southern shore.	--Another finger, but bigger this time. --Medium density, about 125' long and 70' wide. --Max. depth of about 2' with significant broken stems present.

Appendix 5 (continued)	Clark Lake Hardstem Bulrush Mapping	
br14	About 150' east of "br13" on southern shore.	--More of a point combined with a shoreline piece. --Nice patch, very dense on the shore and fairly dense out on the point. --Max. depth of about 3' with significant broken stems, but primarily on the northern half of the bed.
br15	About 250' east of "br14" near a log home with a stone wall facing the lake and a stone chimney.	--Dense shoreline piece about 150' long and 50' out. --One pier in the East end of the section. --Max. depth of about 1.5' with a very small amount of broken stems.
br16	Just east of the log home and about 50' east of "br15".	--Fairly dense, about 150' long and 30-40' out. --Pier extends into the lake further than the bulrush. --Max. depth of about 1' with no broken stems.
br17	About 100' east of "br16" on southern shore.	--About 120' long and 10-20' out. --Fairly dense. --Max. depth of about 1' with some broken stems on the outer 1' perimeter. --Very distinct rhizome reproduction—"stringers". --Rip-rap shoreline.
br18	Western-most island of bulrush, and directly north of "br16".	--Medium density and about 250' diameter circular shaped bed. --Max. depth of about 3' with significant broken stems throughout the bed.
br19	Island about 250' northeast of "br18".	--Medium density and about 175' feet east to west by 100' feet north to south. --Max. depth of about 3' with significant broken stems throughout the bed.
br20	Island about ½ way in between "br19 and br 20".	--About 125' long by 15' wide --Max. depth of about 3' with a severe case of broken stems.
br21	Island in southeastern area of lake.	--Max. depth of about 3' with significant broken stems.
br22	About 75' to the east of "br21"	--Max. depth of about 2.5' with significant broken stems. --Dense stand.
br23	Includes the Whitefish Dunes State Park access beach and follows the shoreline for a long ways, inside distinctive bulrush fingers off the eastern part of South shore.	--Contains both thick inner strip and sparser outer edges.
br24	On southern shore inside of large eastern-most finger—"br28"	--Medium density.
br25	On southern shore inside of large eastern-most finger—"br28"	--Slightly more dense than "br24".
br26	Slightly west of small sand point that is directly north of the connected pond to the southeastern most bay of the lake.	--Medium density.
br27	On little sand point directly north of the pond.	--5' out and 30' of shoreline --Very Healthy!
br28	Eastern-most finger off south shoreline. Pond entrance is right where the bed adjoins the shoreline.	--Very thick on the Southern edge of the finger. --Much sparser on the northern edge of finger.
br29	Near large White Pine on the shoreline.	--Twenty feet of shoreline and 10' out --Very dense and looks healthy.
br30	In southeastern bay of lake.	--Sparse and younger looking.
br31	About 10' south of larger shoreline fringe bed "br32"	--Twenty feet of shoreline, 5' out. --Younger looking.

Appendix5 (continued)	Clark Lake Hardstem Bulrush Mapping	
br32	North end is by house (log cabin) with large Willow tree right on the waters edge.	--Shoreline stretch primarily no further out than 10'. --Dense, but does not extend out deeper than 1' of water for most part.
br33	Eastern shore of southeastern bay	--Three sided sedge, no bulrush --Nice bed of rush
br34	Eastern shore of southeastern bay	--Bulrush healthy and in good shape --Strong clustering
br35	North bay of southeastern bay.	--Massive bulrush stand --Tall and healthy, lots of growth
br36	Large island of sparse bulrush in the southeastern bay.	--Lots of damage to the bulrush.
br37	About 100' south of "br35".	--Not very dense.
br38	Just around the point from "br37"	
br39	About 100' west of "br38"	--Small bulrush stand --About 400 sq. ft. area.
br40	Shoreline bed on east side of point dividing SE lobe of lake from rest. Southern edge starts about 200' north of tip of the point.	--Rip-rap shoreline. --minimal bulrush.
br41	Island, just east of "br42"	--Very sporadic
br42	Shoreline bed on east side of point dividing SE lobe of lake from rest.	--Bulrush looks very healthy near shore.
br43	On southern tip of point, near shore.	
br44	Just around south tip on west side.	--Bulrush very near shore and shallow.
br45	About 20' north of "br44"	--Thick bed near shore and healthy.
br46	About 50' north of "br45"	--Nice healthy bed, near shore.
br47	Eastern shore of north half of lake	--Nice healthy bed, near shore.
br48	Eastern shore of north half of lake	
br49	Eastern shore of north half of lake	
br50	Eastern shore of north half of lake	
br51	Eastern shore of north half of lake	--Mix of bulrush and three square sedges and other juncus
br52	Eastern shore of north half of lake	--Mixed bulrush, juncus sp., three square sedges, cattails, and phragmites. --Very thick bed.
br53	Eastern shore of north half of lake	--Longer sliver of very thick, healthy bulrushes.
br54	Eastern shore of north half of lake	--Mix of sedge, bulrush, cattail, and juncus. --Minimal bulrush.
br55	Eastern shore of north half of lake	--Mix of bulrush, juncus, sedge and cattail --A lot of healthy bulrush on the north side of the bed.
br56	North end of bay on eastern shore of north half of the lake.	--Dense stand and healthy looking. --Not more than 200' long.
br57	About 500 feet north of rocky point along eastern side of point.	
br58	Shoreline piece on rocky point near eastern boat landing.	--Isolated patch along shoreline with coarse woody debris near on shoreline.

Appendix 5 (continued)	Clark Lake Hardstem Bulrush Mapping	
br59	Shoreline piece on rocky point near eastern boat landing.	--Mainly a 5-10' fringe along the shoreline.
br60	Eastern shore of northern-most lobe of lake.	--About 15' long by 5' out.
br61	Eastern shore of northern-most lobe of lake.	--About 5' long by 2' out.
br62	Eastern shore of northern-most lobe of lake.	--About 15' long by 5' out. --Isolated and sparse.
br63	Eastern shore of northern-most lobe of lake.	--About 20' long by 5' out. --Sparse
br64	Eastern shore of northern-most lobe of lake.	--About 20' long by 10' out. --Very sparse and separated from "br65" by a dock.
br65	Eastern shore of northern-most lobe of lake.	--About 50' out into the lake by a 20' base forming a triangular shape pointing southwest.
br66	Eastern shore of northern-most lobe of lake.	--About 20' by 20' with moderate density. --Separated from "br67" by a beach that the bulrush is remotely present on, but looks to be highly favorable to reestablishment.
br67	Shoreline piece in north lobe of the lake, just to the east of large healthy bulrush stand.	--Dense and healthy looking
br68	Largest bed in north lobe of the lake starting just east of inlet of Logan Creek.	--Very dense, especially the northwest half of the bed. --Sparser on the southeast half.
br69	First bed west of inlet, butting up to the northern lookout platform of the Ridges land.	--About 80' long by 50' out --Very thick and healthy, lots of nutlets.
br70	Bulrush island in western part of North lobe of the lake.	--About 100' south to north by 40' wide, creating an oval shape. --Separated from "br72" by only a few feet.
br71	Isolated island in western part of North lobe of the lake.	--20' SW pointing NE by 10' wide
br72	Shoreline piece joining the Ridges Sanctuary southern lookout tower on western shore.	--Large bed and very dense.
br73	Island narrowly separated from shore east of rock bar point on western shore of north lobe of the lake.	--Spotty groups of dense bulrush.
br74	Island growing out of actual rock bar from the point.	--Some dense pieces, but mainly sparse groupings.
br75	Northwest lobe of lake on southern side of rock bar point.	--Big and dense with sparser outer fringes. --Small 5-20 meter gap between "br74" because of rock bar point substrate --Little patch growing on the rocks of the point.
br76	Northwest lobe of lake just south of "br76".	--Moderately thick, Sparse on the north side --About 100' out from shore and 150' long *Property owner says the bulrush in this area has thickened in the past 10 years including the submergent macrophytes.

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